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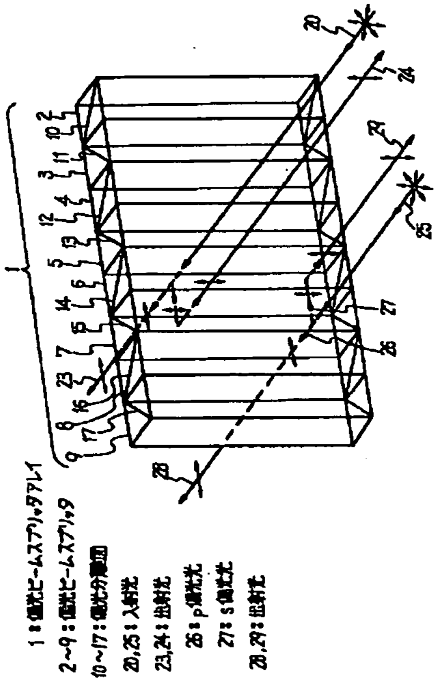
(54)【発明の名称】　偏光ビームスプリッタアレイ

(57)【要約】
【目的】光束径が大きく、非常に強い光に使用する偏光子を得る。

【構成】偏光ビームスプリッタアレイ１は、複数の、例として８個の偏光ビームスプリッタ２～９で構成される。偏光ビームスプリッタ２～９は、ｓ偏光光２７の反射方向と平行な方向に隣接して配置する。隣合う偏光ビームスプリッタ２～９の偏光分離面１０～１７は、互いに直交するように配置する。入射光２０、２５のｐ偏光成分は、偏光ビームスプリッタアレイ１を透過し、ｓ偏光成分は反射する。



【特許請求の範囲】

【請求項１】　不定偏光光を互いに偏光方向が直交する２つの直線偏光光であるｐ偏光光とｓ偏光光とに分離する偏光分離面が形成された複数の偏光ビームスプリッタを、前記偏光分離面が互いに直交するように、前記ｓ偏光光の反射方向と平行な方向に隣接して配置したことを特徴とする偏光ビームスプリッタアレイ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、不定偏光光から直線偏光光を得る偏光ビームスプリッタアレイに関する。

【０００２】

【従来の技術】偏光光を使用する機器その他の装置には、直線偏光光を利用するものがある。直線偏光光を利用する装置の一例は、ＴＮ（ツイステッド・ネマティック）液晶表示素子の表示画像を、光源と投射レンズを用いて、スクリーン上に拡大投射する投射型液晶表示装置である。

【０００３】従来、そのような装置において、光源としてハロゲンランプ、キセノンランプ、メタルハライドランプ等を使用する場合、それらの光源から発生する光は不定偏光光であり、従って、直線偏光光を得るには偏光板や偏光ビームスプリッタ等の偏光子が用いられている。

【０００４】

【発明が解決しようとする課題】しかし、従来の偏光板を投射型液晶表示装置に用いる場合、偏光板の透過率が５０％以下であるため、投射画面が暗くなってしまう。投射画面を明るくするために輝度の高い光源を用いると、偏光板で吸収された光が熱に変わり、偏光板の温度が非常に高くなる。偏光板は、ポリビニルアルコールフィルムに沃素等を配向させて吸着させることにより偏光膜を製作し、画面に保護のためにトリアセテートやアクリル等のプラスチックシートを接着した構造であるため耐熱性が弱く、温度上昇により性能が劣化する。従って、輝度の高い光源を用いると、偏光板は熱により劣化し、偏光度が低下する。偏光板の偏光度が低下すると、投射画面のコントラストが低くなり、画質が著しく損なわれるという問題がある。

【０００５】一方、偏光ビームスプリッタは、二つの直角プリズムの一方の斜面に誘電体多層膜からなる半透膜をコートして斜面どおしを接合した構造であり、斜面において透過光と反射光とを互いに偏光方向が直交する二つの直線偏光光として分離する。このような偏光ビームスプリッタは、材質がガラスと誘電体多層膜であり、耐熱性に優れている。また、光をほとんど吸収しないので、高出力光源を使用しても、性能は劣化しない。しかし、投射型液晶表示装置に使用する場合、光源からの投射光束の直径が大きいので、大きなサイズの偏光ビームスプリッタを使用する必要がある。従って、光学系が大きくなり、重量も重くなるため、投射装置の小型、軽量化が困難になる。また、大きくて均質なガラス材を入手するのにコストがかかり、装置コストの増加という問題も生じる。

【０００６】本発明の目的は、非常に強い光を照射しても性能が劣化せず、また投射装置の小型化、軽量化、低コスト化に効果がある偏光子として使用できる偏光ビームスプリッタアレイを提供することにある。

【０００７】

【課題を解決するための手段】上記目的を達成するために、本発明の偏光ビームスプリッタアレイは、不定偏光光を互いに偏光方向が直交する２つの直線偏光光であるｐ偏光光とｓ偏光光とに分離する偏光分離面が形成された複数の偏光ビームスプリッタを、前記偏光分離面が互いに直交するように、前記ｓ偏光光の反射方向と平行な方向に隣接して配置したことを特徴とする。

【０００８】

【作用】本発明の上記構成によれば、偏光ビームスプリッタに形成された偏光分離面において、偏光ビームスプリッタアレイに入射した不定偏光光は、ｐ偏光成分の光はそのまま透過し、ｓ偏光成分の光は反射されることにより、互いに偏光方向が直交する２つの直線偏光光に分離される。ｐ偏光光は偏光ビームスプリッタアレイを透過し出射光となる。一方、反射したｓ偏光光は、隣接する偏光ビームスプリッタに入射し、再び偏光ビームスプリッタに形成された偏光分離面で反射される。ここで、隣接する偏光ビームスプリッタどおしの偏光分離面は、互いに直交しているので、結局ｓ偏光光は、不定偏光光の入射方向と反対方向に出射する。同様に、偏光ビームスプリッタアレイを構成する全ての偏光ビームスプリッタに入射する不定偏光光は、上述の光路により、ｐ偏光光はそのまま透過し、ｓ偏光光は入射方向と反対方向に反射することになり、偏光ビームスプリッタアレイは、偏光子として作用する。

【０００９】このような偏光ビームスプリッタアレイは、従来の偏光板と比べると、材質がガラスであるため耐熱性に優れており、投射型液晶表示装置に使用する場合、高輝度の光源が使用でき、投射画面を明るくすることが可能になる。また、従来の偏光ビームスプリッタと比べても、例えば、２個の偏光ビームスプリッタをアレイ状に配置すると、厚さ、並びに重量が半分になり、さらに１０個の偏光ビームスプリッタをアレイ状に配置すると、厚さ、並びに重量が１／１０になるというように、投射型液晶表示装置に使用する場合、投射装置の小型、軽量化に効果がある。

【００１０】

【実施例】以下、本発明の実施例について図面を参照して説明する。図１は、本発明の実施例を示す偏光ビームスプリッタアレイの斜視図である。

【００１１】この偏光ビームスプリッタアレイ１は、不

定偏光光を互いに偏光方向が直交する２つの直線偏光光であるｐ偏光光とｓ偏光光とに分離する偏光分離面１０～１７がそれぞれ形成された８個の偏光ビームスプリッタ２～９で構成され、それらは、ｓ偏光光２７が反射する方向と平行な方向に隣接して配置されている。また、隣合う偏光ビームスプリッタ２～９の偏光分離面１０～１７は、それぞれ互いに直交するように配置されている。

【００１２】図１に示した構成の、本発明に従う偏光ビームスプリッタアレイ１が、偏光子として作用する原理を図２を用いて説明する。図２は、図１の偏光ビームスプリッタアレイ１の部分断面図であり、偏光ビームスプリッタ６、７の近傍を拡大している。図２において、偏光ビームスプリッタ６と偏光ビームスプリッタ７には、不定偏光光を互いに偏光方向が直交する２つの直線偏光光に分離する偏光分離面１４と１５が、それぞれ入射光２０と、２５に対し、４５°の角度で形成されている。不定偏光光である入射光２０、２５が、偏光分離面１４、１５にそれぞれ入射すると、ｐ偏光光２１、２６は透過し、ｓ偏光光２２、２７は反射する。偏光ビームスプリッタ６と偏光ビームスプリッタ７は、ｓ偏光光２２、２７の反射方向と平行な方向に隣接し、偏光分離面１４と偏光分離面１５が互いに直交するように配置されている。

【００１３】ここで、偏光ビームスプリッタ６に不定偏光光である入射光２０が入射すると、偏光分離面１４におあいて、ｐ偏光光２１は透過し、ｓ偏光光２２は反射して、２つの直線偏光光に分離される。ｐ偏光光２１は、そのまま偏光ビームスプリッタ６を出射し、出射光２３となる。一方、ｓ偏光光２２は、隣接する偏光ビームスプリッタ７に入射し、偏光分離面１５において再び反射され、偏光ビームスプリッタ７から出射する。偏光分離面１４と偏光分離面１５は、互いに直交しているので、ｓ偏光光２２は、入射光２０と逆方向に伝搬する出射光２４となる。同様に、偏光ビームスプリッタ７に不定偏光光である入射光２５が入射すると、偏光分離面１５において、ｐ偏光光２６は透過し、ｓ偏光光２７は反射して、２つの直線偏光光に分離される。ｐ偏光光２６は、そのまま偏光ビームスプリッタ７を出射し、出射光２８となる。一方、ｓ偏光光２７は、隣接する偏光ビームスプリッタ６に入射し、偏光分離面１４において再び反射され、偏光ビームスプリッタ６から出射する。偏光分離面１４と偏光分離面１５は、互いに直交しているので、ｓ偏光光２７は、入射光２５と逆方向に伝搬する出射光２９となる。従って、偏光ビームスプリッタアレイ１を構成する偏光ビームスプリッタ６、７は、ｐ偏光光２１、２６を透過し、ｓ偏光光２２、２７を入射方向と反対方向に反射することで、不定偏光光である入射光２０、２５を、互いに偏光方向が直交する直線偏光光に分離することができ、偏光子として作用する。

【００１４】以上の説明から明かなように、図１における偏光ビームスプリッタ２と３、４と５、８と９は、偏光ビームスプリッタ６と７と同様に、ｐ偏光光を透過し、ｓ偏光光を反射することで、不定偏光光を互いに偏光方向が直交する２つの直線偏光光に分離できるので、それら８個の偏光ビームスプリッタ２～９で構成される偏光ビームスプリッタアレイ１は、偏光子として作用する。

【００１５】図１に示した構成は、８個の偏光ビームスプリッタ２～９を用いる場合の態様の一例を示したものであり、以下、これについて更に具体的に説明する。図１において、偏光ビームスプリッタ２～９は、それぞれ、２個の直角プリズムの一方の斜面に誘電体多層膜からなる半透膜をコートして斜面どおしを接合した構造であり、特に、可視光領域の波長の不定偏光光に対して、十分にｐ偏光光とｓ偏光光とに分離できる性能を有するものを用いた。その消光比、すなわち透過光のｐ偏光成分のｓ偏光成分の光の強度比は、１００：１以上であった。隣合う偏光ビームスプリッタ２～９は、それぞれ境界面で反射光が生じないように、屈折率の整合をとった接着剤で貼合わせている。接着剤の部分は、偏光を分離する作用はなく、光を透過しないが、その厚さは１００μｍ以下であり、偏光ビームスプリッタアレイ１の光の入射面の面積に占める割合は１％以下となり、透過光量の損失は非常に小さい。偏光ビームスプリッタアレイ１の光の入射面、および出射面には、誘電体多層膜からなる反射防止膜を施してある。それぞれの偏光ビームスプリッタ２～９のサイズは、１０×６０×１０ｍｍであり、従って、偏光ビームスプリッタアレイ１のサイズは、８０×６０×１０ｍｍである。

【００１６】このような偏光ビームスプリッタアレイを、従来のプラスチックからなる偏光板と比べると、材質ガラスと誘電体多層膜であるため耐熱性に優れている。例えば、５００Ｗのキセノンランプからの放射光を、偏光ビームスプリッタアレイに直接照射しても、透過率、偏光度等の性能の経時変化は生じなかった。従って、偏光ビームスプリッタアレイを投射型液晶表示装置に使用する場合、高出力の光源を使用でき、投射画面を明るくすることが可能になった。

【００１７】また、従来の偏光ビームスプリッタと比べても、８個の偏光ビームスプリックをアレイ状に配置することにより、厚さ、並びに重量が１／８になり、液晶表示装置に使用する場合、投射装置の小型、軽量化に効果があった。さらに、各偏光ビームスプリッタは、サイズの小さいガラスで製作でき、大きくて均質な晶材を入手する必要がないため、コストを低減できた。

【００１８】以上、本実施例の説明において、偏光ビームスプリッタの個数は、２個以上であれば同様の効果が得られる。また、偏光ビームスプリッタアレイは、偏光分離面に垂直な面で分離した偏光ビームスプリッタを用

いて構成することも可能である。偏光ビームスプリッタアレイから出射する直線偏光光の偏光方向を変える場合には、偏光ビームスプリッタアレイを、光の入射方向を軸に回転させると、所望の偏光方向を持つ直線偏光光が得られる。さらに、出射光の偏光度を向上させるために、出射光の光路中に従来の偏光板を挿入しても良い。この場合、偏光板に入射する光は、あらかじめ直線偏光化されているので、偏光ビームスプリッタアレイは、偏光板の光の吸収による熱の発生、並びに、それに伴う性能の劣化を低減する効果もある。なお、本発明の偏光ビームスプリッタアレイは、投射型液晶表示装置のみならず、偏光光を使用する機器や装置に対して有効である。

【００１９】

【発明の効果】以上説明したように、本発明によれば、非常に強い光を照射しても性能が劣化しない偏光子として使用できる、軽量、薄型の偏光ビームスプリッタアレイを得ることができた。本偏光ビームスプリッタアレイは、投射型液晶表示装置において、高出力光源の使用を可能にし、投射画面の高輝度化を実現でき、さらに、偏光光を使用する機器や装置の小型化、軽量化、低コスト化にも効果がある。

【図面の簡単な説明】

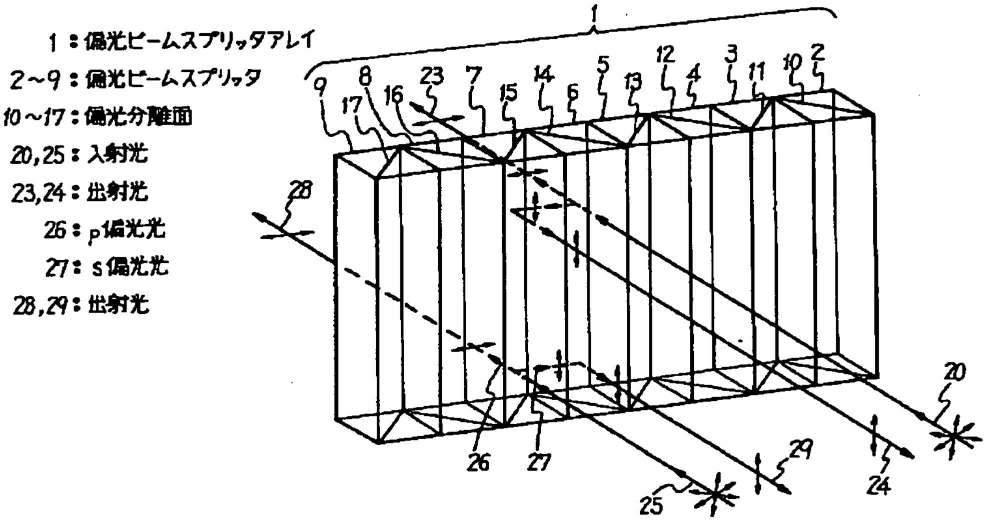
【図１】本発明の実施例を示す偏光ビームスプリッタアレイの斜視図。

【図２】本発明の実施例を示す偏光ビームスプリッタアルイの部分断面図。

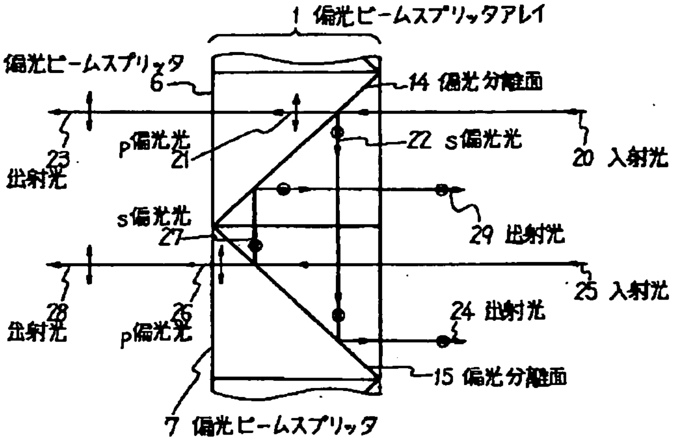
【符号の説明】

１	偏光ビームスプリッタアレイ
２～９	偏光ビームスプリッタ
１０～１７	偏光分離面
２０，２５	入射光
２１，２６	ｐ偏光光
２２，２７	ｓ偏光光
２３，２４，２８，２９	出射光

【図１】



【図２】


1 偏光ビームスプリッタアレイ
偏光ビームスプリッタ 6
14 偏光分離面
p偏光光 21
22 s偏光光
20 入射光
23 出射光
s偏光光 27
29 出射光
25 入射光
28 出射光
26 p偏光光
24 出射光
15 偏光分離面
7 偏光ビームスプリッタ

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(21)Application number :	03-168546	(71)Applicant :	NEC CORP
(22)Date of filing :	10.07.1991	(72)Inventor :	IMAI MASAO

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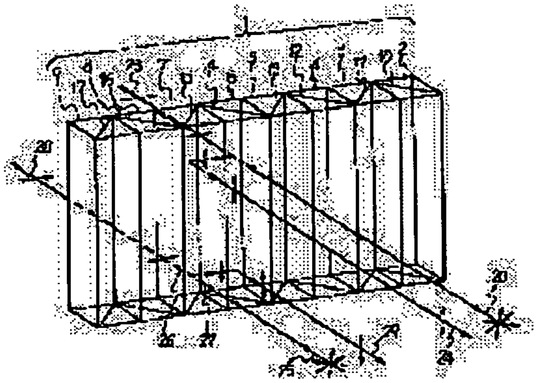
(54) POLARIZATION BEAM SPLITTER ARRAY

(57)Abstract:
PURPOSE: To obtain a polarizer which has a large luminous flux diameter and is used for a very intense light.
CONSTITUTION: The polarization beam splitter array is constituted of plural, for instance, eight pieces of polarization beam splitters 2-9. The polarization beam splitter 2-9 are placed adjacently in the direction being parallel to the reflecting direction of an (s) polarized light 27. The polarization separating surfaces 10-17 of the adjacent polarization beam splitters 2-9 are placed so as to be orthogonal to each other. A (p) polarization component of incident light 20, 25 transmits through the polarization beam splitter array 1, and an (s) polarization component is reflected.



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[Kind of final disposal of application other than th examiner's decision of rejection or application converted registration]	
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PATENT ABSTRACTS OF JAPAN

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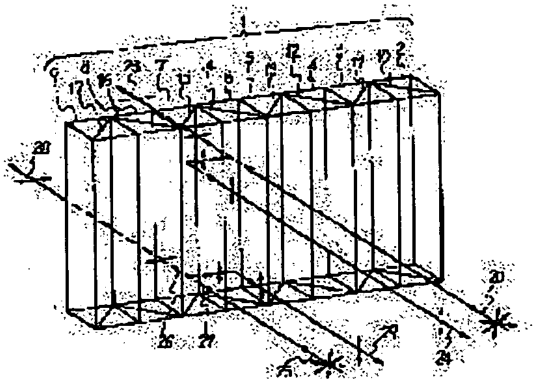
·4) POLARIZATION BEAM SPLITTER ARRAY

·7)Abstract:
URPOSE: To obtain a polarizer which has a large luminous flux diameter ıd is used for a very intense light.
ONSTITUTION: The polarization beam splitter array is constituted of ural, for instance, eight pieces of polarization beam splitters 2-9. The ›larization beam splitter 2-9 are placed adjacently in the direction being ırallel to the reflecting direction of an (s) polarized light 27. The ›larization separating surfaces 10-17 of the adjacent polarization beam ›litters 2-9 are placed so as to be orthogonal to each other. A (p) ›larization component of incident light 20, 25 transmits through the ›larization beam splitter array 1, and an (s) polarization component is ›flected.



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AIMS

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laim(s)]
laim 1] The polarization beam splitter array characterized by having adjoined in the direction parallel to the
flective direction of the aforementioned s-polarized light light, and having arranged two or more polarization beam
litters in which the polarization separation side which divides unfixed polarization light into the p-polarized light
ght which is two linearly polarized light light light and the polarization direction cross at right angles mutually, and s-
larized light light was formed so that the aforementioned polarization separation side may intersect perpendicularly
utually.

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:TAILED DESCRIPTION

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etailed Description of the Invention]

)01]

ıdustrial Application] this invention relates to the polarization beam splitter array which obtains linearly polarized ;ht light from unfixed polarization light.

)02]

escription of the Prior Art] There is a thing using linearly polarized light light in the equipment of the device which es polarization light, and others. An example using linearly polarized light light of equipment is a projected type uid crystal display which carries out expansion projection of the display image of TN (Twisted Nematic) liquid ,stal display element on a screen using the light source and a projector lens.

)03] Conventionally, when using a halogen lamp, a xenon lamp, a metal halide lamp, etc. as the light source in such uipment, the light generated from those light sources is unfixed polarization light, therefore polarizers, such as a larizing plate and a polarization beam splitter, are used for obtaining linearly polarized light light.

)04]

roblem(s) to be Solved by the Invention] However, since the permeability of a polarizing plate is 50% or less when ing the conventional polarizing plate for a projected type liquid crystal display, a projection screen will become dark. the light source with high brightness is used in order to make a projection screen bright, the light absorbed with the larizing plate will change to heat, and the temperature of a polarizing plate will become very high. A polarizing plate ınufactures a polarization film by carrying out orientation of the iodine etc. to a polyvinyl alcohol film, and making it ck to it, since it is the structure which pasted up sheets plastic, such as a triacetate and an acrylic, on the screen for otection, thermal resistance is weak, and a performance deteriorates by the temperature rise. Therefore, if the light urce with high brightness is used, a polarizing plate will deteriorate with heat and degree of polarization will fall. hen the degree of polarization of a polarizing plate falls, the contrast of a projection screen becomes low and there is roblem that quality of image is spoiled remarkably.

)05] On the other hand, a polarization beam splitter is the structure which carried out the coat of the semipermeable embrane which becomes one slant face of two rectangular prisms from a dielectric multilayer, and joined slant-face tirety, and separates the transmitted light and the reflected light on a slant face as two linearly polarized light light ;ht and the polarization direction cross at right angles mutually. The quality of the materials are glass and a dielectric ıltilayer, and such a polarization beam splitter is excellent in thermal resistance. Moreover, since light is hardly sorbed, even if it uses the high power light source, a performance does not deteriorate. However, since the diameter the incident-light bunch from the light source is large when using it for a projected type liquid crystal display, it is cessary to use the polarization beam splitter of big size. Therefore, since optical system becomes large and a weight so becomes heavy, small [of a projection device] and lightweight-ization become difficult. Moreover, cost starts that ge and homogeneous glass material comes to hand, and the problem of an equipment increase in cost is also oduced.

006] The purpose of this invention is to offer the polarization beam splitter array which can be used as a polarizer ıich a performance does not deteriorate even if it irradiates a very strong light, and has an effect in miniaturization of a projection device], lightweight-izing, and low-cost-ization.

007]

leans for Solving the Problem] In order to attain the above-mentioned purpose, it carries out that adjoined in the rection parallel to the reflective direction of the aforementioned s-polarized light light, and the polarization beam litter array of this invention has arranged two or more polarization beam splitters in which the polarization separation le which divides unfixed polarization light into the p-polarized light light which is two linearly polarized light light ;ht and the polarization direction cross at right angles mutually, and s-polarized light light was formed so that the

)rementioned polarization separation side may intersect perpendicularly mutually as the feature.

)08]

unction] According to the above-mentioned composition of this invention, in the polarization separation side formed the polarization beam splitter, the unfixed polarization light which carried out incidence to the polarization beam litter array penetrates the light of a p-polarized light component as it is, and the light of an s-polarized light mponent is divided into two linearly polarized light light light and the polarization direction cross at right angles ıtually by being reflected. P-polarized light light penetrates a polarization beam splitter array, and turns into tgoing radiation light. On the other hand, incidence of the reflected s-polarized light light is carried out to an joining polarization beam splitter, and it is reflected in respect of the polarization separation again formed in the larization beam splitter. Here, since the polarization separation side of adjoining polarization-beam-splitter entirety s at right angles mutually, outgoing radiation of the s-polarized light light is carried out to the direction of incidence d opposite direction of unfixed polarization light after all. By the optical path with an above-mentioned unfixed larization light which similarly carries out incidence to all the polarization beam splitters that constitute a larization beam splitter array, p-polarized light light will be penetrated as it is, s-polarized light light will be reflected the direction of incidence, and opposite direction, and a polarization beam splitter array acts as a polarizer.

)09] It becomes possible to be able to use the light source of high brightness and to make a projection screen bright, ıen such a polarization beam splitter array is excellent in thermal resistance and it uses it for a projected type liquid ystal display, since the quality of the material is glass compared with the conventional polarizing plate. Moreover, en if compared with the conventional polarization beam splitter, if two polarization beam splitters are arranged in the ape of an array, thickness and a weight will become half, and when using it for a projected type liquid crystal display thickness and a weight become 1/10 if ten more polarization beam splitters are arranged in the shape of an array, an fect is in small [of a projection device], and lightweight-ization, for example.

)10]

xample] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 is the rspective diagram of a polarization beam splitter array showing the example of this invention.

)11] The polarization separation sides 10-17 where this polarization beam splitter array 1 divides unfixed larization light into the p-polarized light light which is two linearly polarized light light light and the polarization rection cross at right angles mutually, and s-polarized light light consist of eight polarization beam splitters 2-9 rmed, respectively, and they adjoin in the direction parallel to the direction which the s-polarized light light 27 flects, and are arranged. Moreover, the polarization separation sides 10-17 of the ****** polarization beam splitters 9 are arranged so that it may intersect perpendicularly mutually, respectively.

012] The polarization beam splitter array 1 according to this invention of composition of having been shown in awing 1 explains the principle which acts as a polarizer using drawing 2 . Drawing 2 is the fragmentary sectional ew of the polarization beam splitter array 1 of drawing 1 , and is expanded near the polarization beam splitters 6 and In drawing 2 , the polarization separation sides 14 and 15 which divide unfixed polarization light into two linearly larized light light light and the polarization direction cross at right angles mutually are formed in the polarization am splitter 6 and the polarization beam splitter 7 at the angle of 45 degrees to incident lights 20 and 25, respectively. the incident lights 20 and 25 which are unfixed polarization light carry out incidence to the polarization separation les 14 and 15, respectively, the p-polarized light light 21 and 26 will penetrate, and will reflect the s-polarized light ght 22 and 27. A polarization beam splitter 6 and a polarization beam splitter 7 adjoin in the direction parallel to the flective direction of the s-polarized light light 22 and 27, and they are arranged so that the polarization separation le 14 and the polarization separation side 15 may intersect perpendicularly mutually.

013] Here, if the incident light 20 which is unfixed polarization light carries out incidence to a polarization beam litter 6, it will open in the polarization separation side 14, and the p-polarized light light 21 penetrates, it will reflect d the s-polarized light light 22 will be divided into two linearly polarized light light. The p-polarized light light 21 rries out outgoing radiation of the polarization beam splitter 6 as it is, and turns into the outgoing radiation light 23. ı the other hand, incidence of the s-polarized light light 22 is carried out to the adjoining polarization beam splitter 7, the polarization separation side 15, it is reflected again, and outgoing radiation of it is carried out from a polarization am splitter 7. Since the polarization separation side 14 and the polarization separation side 15 lie at right angles utually, the s-polarized light light 22 turns into an incident light 20 and the outgoing radiation light 24 spread to an posite direction. If similarly the incident light 25 which is unfixed polarization light carries out incidence to a larization beam splitter 7, in the polarization separation side 15, the p-polarized light light 26 penetrates, it will flect and the s-polarized light light 27 will be divided into two linearly polarized light light. The p-polarized light ght 26 carries out outgoing radiation of the polarization beam splitter 7 as it is, and turns into the outgoing radiation ght 28. On the other hand, incidence of the s-polarized light light 27 is carried out to the adjoining polarization beam litter 6, in the polarization separation side 14, it is reflected again, and outgoing radiation of it is carried out from a larization beam splitter 6. Since the polarization separation side 14 and the polarization separation side 15 lie at right gles mutually, the s-polarized light light 27 turns into an incident light 25 and the outgoing radiation light 29 spread an opposite direction. Therefore, the polarization beam splitters 6 and 7 which constitute the polarization beam litter array 1 can penetrate the p-polarized light light 21 and 26, can divide the incident lights 20 and 25 which are fixed polarization light into the linearly polarized light light light and the polarization direction cross at right angles ıtually by reflecting the s-polarized light light 22 and 27 in the direction of incidence, and opposite direction, and act a polarizer.

)14] the Ming kana from the above explanation -- like, it is that the polarization beam splitters 2 and 3 in drawing 1 , and 5, 8 and 9 penetrate p-polarized light light like polarization beam splitters 6 and 7, and it reflects s-polarized ;ht light, and since unfixed polarization light is separable into two linearly polarized light light light and the larization direction cross at right angles mutually, the polarization beam splitter array 1 which consists of these eight larization beam splitters 2-9 acts as a polarizer

)15] The composition shown in drawing 1 shows an example of the mode in the case of using eight polarization am splitters 2-9, and explains it still more concretely about this hereafter. In drawing 1 , polarization beam splitters 9 are the structures which carried out the coat of the semipermeable membrane which becomes one slant face of two :tangular prisms from a dielectric multilayer, respectively, and joined slant-face entirety, and what has a performance lly separable into p-polarized light light and s-polarized light light to the unfixed polarization light of the wavelength a light field especially was used for them. The extinction ratio, i.e., the luminous-intensity ratio of the s-polarized ;ht component of the p-polarized light component of the transmitted light, was 100:1 or more. The ****** larization beam splitters 2-9 are the adhesives which took adjustment of a refractive index so that the reflected light ght not arise in an interface, respectively, and are lamination ******. Although there is no operation whose portion adhesives separates polarization and light is not penetrated, the thickness is 100 micrometers or less, the rate for ıich it accounts in the area of the plane of incidence of the light of the polarization beam splitter array 1 becomes 1% less, and loss of the amount of transmitted lights is very small. The antireflection film which consists of a dielectric ıltilayer is given to the plane of incidence and the outgoing radiation side of light of the polarization beam splitter :ay 1. The size of each polarization beam splitter 2-9 is 10x60x10mm, therefore the size of the polarization beam litter array 1 is 80x60x10mm.

)16] Since it is quality-of-the-material glass and a dielectric multilayer compared with the polarizing plate which nsists of conventional plastics, such a polarization beam splitter array is excelled in thermal resistance. For example, en if it irradiated the polarization beam splitter array directly, aging of performances, such as permeability and gree of polarization, did not produce the synchrotron orbital radiation from the xenon lamp of 500W. Therefore, ıen a polarization beam splitter array was used for a projected type liquid crystal display, the light source of high wer could be used and it became possible to make a projection screen bright.

)17] Moreover, even if compared with the conventional polarization beam splitter, when thickness and a weight ɛre set to one eighth and used it for a liquid crystal display by arranging eight polarization beam splitters in the shape an array, the effect was in small [of a projection device], and lightweight-ization. Furthermore, since each larization beam splitter was able to be manufactured with glass with small size and did not need to receive large and mogeneous ** material, it has reduced cost.

)18] As mentioned above, in explanation of this example, if the number of a polarization beam splitter is two or ɔre pieces, the same effect will be acquired. Moreover, a polarization beam splitter array can also be constituted ing the polarization beam splitter separated in respect of being perpendicular to a polarization separation side. If it tates a polarization beam splitter array centering on the direction of incidence of light in changing the polarization :ection of the linearly polarized light light which carries out outgoing radiation from a polarization beam splitter :ay, linearly polarized light light with the desired polarization direction will be obtained. Furthermore, in order to se the degree of polarization of outgoing radiation light, you may insert the conventional polarizing plate into the tical path of outgoing radiation light. In this case, since light which carries out incidence to a polarizing plate is ıearly-polarized-light-ized beforehand, as for a polarization beam splitter array, it has generating of the heat by the sorption of light of a polarizing plate, and the effect of reducing degradation of the performance accompanying it. In dition, the polarization beam splitter array of this invention is effective to the device and equipment which use not ly a projected type liquid crystal display but polarization light.

019]

ffect of the Invention] As explained above, according to this invention, lightweight and the thin polarization beam litter array which can be used as a polarizer with which a performance does not deteriorate even if it irradiates a very ong light were able to be obtained. In a projected type liquid crystal display, this polarization beam splitter array ıbles use of the high power light source, and can realize high brightness-ization of a projection screen, and there is effect also in miniaturization [of the device or equipment which use polarization light], lightweight-izing, and low-ıt-ization further.

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RAWINGS

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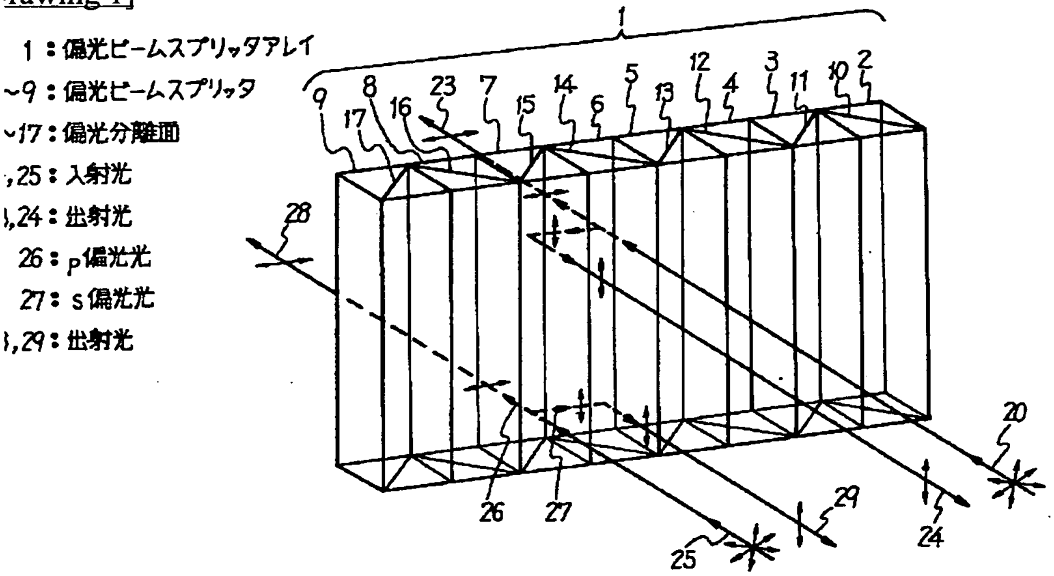
rawing 1]



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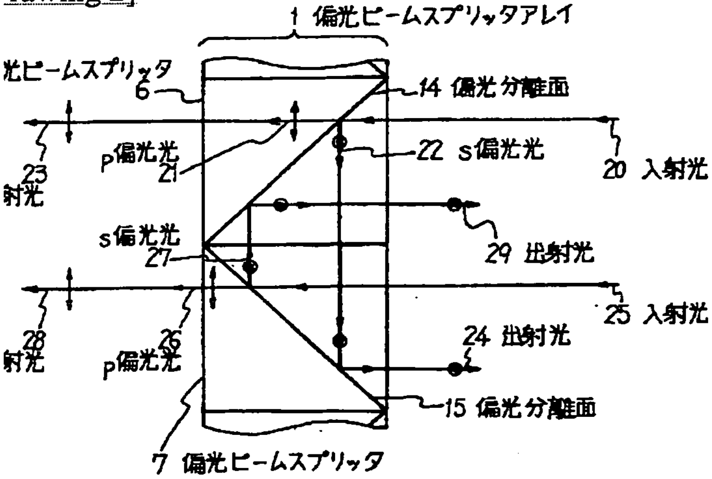

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